

## Secular Trends in Ischemic Heart Disease Mortality in California Versus the United States, 1980 to 1991

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We compare the recent trends in ischemic heart disease mortality in California and the United States. Because California was among the first states to have declines in ischemic heart disease mortality, an examination of these recent trends may provide important clues for upcoming national trends. Age-adjusted and -specific ischemic heart disease mortality rates were calculated by sex for persons aged 35 and older during the years 1980 to 1991. Log-linear regression modeling was used to estimate the average annual percentage change in mortality. Between 1980 and 1991, the annual age-adjusted ischemic heart disease mortality declined less in California than in the United States for both women (1.9% versus 3.1%) and men (3.1% versus 3.5%). In California, it increased slightly between 1986 and 1990 for the oldest women and men. The slower rates of decline in mortality of this disease in California compared with the United States and the rising rates among the most elderly Californians suggest that careful attention should be paid to these trends in death rates of and risk factors for this disease in California.

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In the United States, ischemic heart disease (IHD) has been the leading cause of adult death since the 1930s.<sup>1</sup> During the early part of the century, IHD mortality increased steadily. Since the mid-1960s, however, IHD mortality has declined steadily in the United States<sup>2</sup> and many other industrialized countries.<sup>3</sup> These declines began earlier in some areas, reflecting considerable spatial and demographic variation. Declines began earlier in metropolitan areas than in nonmetropolitan areas and in the Pacific and northeastern states than in the South and midsections of the country.<sup>4</sup> Much of this variation is associated with socioenvironmental characteristics of the regions, such as occupation, education, and the income profile.<sup>5</sup> California was among the earliest states to show declines in IHD mortality.<sup>6</sup> During the early 1950s, IHD mortality in California had already begun to decline, whereas for the United States overall it did not begin to decline until the mid-1960s.<sup>7</sup> We document the recent trends of age- and sex-specific rates of IHD mortality in California and compare them with national trends.

### Methods

We obtained mortality data for California residents from the death certificate computer files of the California

Department of Health Services, Health Data and Statistics Branch, Health Demographics Section. Mortality data for residents of the United States were obtained from the vital statistics files maintained by the National Center for Health Statistics. The computer files were searched for underlying-cause-of-death codes 410 through 414 (according to the *International Classification of Diseases*, 9th revision) for the 1980 through 1991 period.<sup>8</sup> We obtained population estimates for California residents from the California Department of Finance and US population estimates from the US Bureau of the Census.

We calculated age-adjusted mortality for ages 35 and older by using the 1980 US census population as the standard for direct adjustment.<sup>9</sup> The age-specific rates were based on IHD deaths in ten-year age intervals to increase the stability of each age-sex stratum. We calculated the relative change (average annual percentage change in the rate) in IHD mortality by using a log-linear model that assumes a constant proportional change.<sup>10</sup>

### Results

Between 1980 and 1991, age-adjusted IHD mortality declined for women and men in both California and the

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TABLE 1.—Average Annual Percentage Change in Age-Adjusted Rates of Ischemic Heart Disease (IHD) Mortality: California and the United States, 1980 Through 1991 (for Women and Men Aged  $\geq 35$  Years)

Population	Women			Men		
	IHD Mortality Rate*	1991	Average Annual % Change†	IHD Mortality Rate*	1991	Average Annual % Change†
California . . . . .	377	291	-1.9	693	483	-3.1
USA . . . . .	427	305	-3.1	806	548	-3.5

\*Age-adjusted rate per 100,000 person-years.  
†Average annual percentage change based on log-linear regression model of rates (per 100,000 person-years) for persons aged  $\geq 35$  years, age-adjusted to the 1980 US population.

United States (Figure 1). Throughout this study period, IHD mortality in California was consistently lower than that for the United States. Among women, however, the rates in California and the United States nearly overlapped between 1987 and 1991. The rate of decline in IHD mortality during the years 1980 to 1991 was slower for California than for the United States, and in both areas, women experienced slower rates of decline than men (Table 1).

Trends in the age-specific rates of IHD mortality for the United States (available on request) indicate steady declines in rates for each of the ten-year age groups during 1980 through 1991. In California, all age groups showed similar although less consistent declines, except for men and women older than 85 years (Figure 2). In those age groups, the rates declined from 1980 to 1986, increased again until 1990, and then remained at a level

slightly under that of 1980.

In general, age-adjusted IHD mortality for men was almost double that for women. The rates of decline for men were faster than the decline for women, however, resulting in a decrease in the male-to-female ratio over time. In California, the ratio decreased from 1.84 in 1980 to 1.66 in 1991 (10% reduction). In the United States, there was a 5% reduction in the male-to-female ratio from 1.89 in 1980 to 1.80 in 1991.

### Discussion

We have documented a continuing decline in age-adjusted IHD mortality among women and men aged 35 years and older in California and the United States between 1980 and 1991. Although California was among the earliest states to experience a decline in IHD mortality and continues to have lower IHD mortality

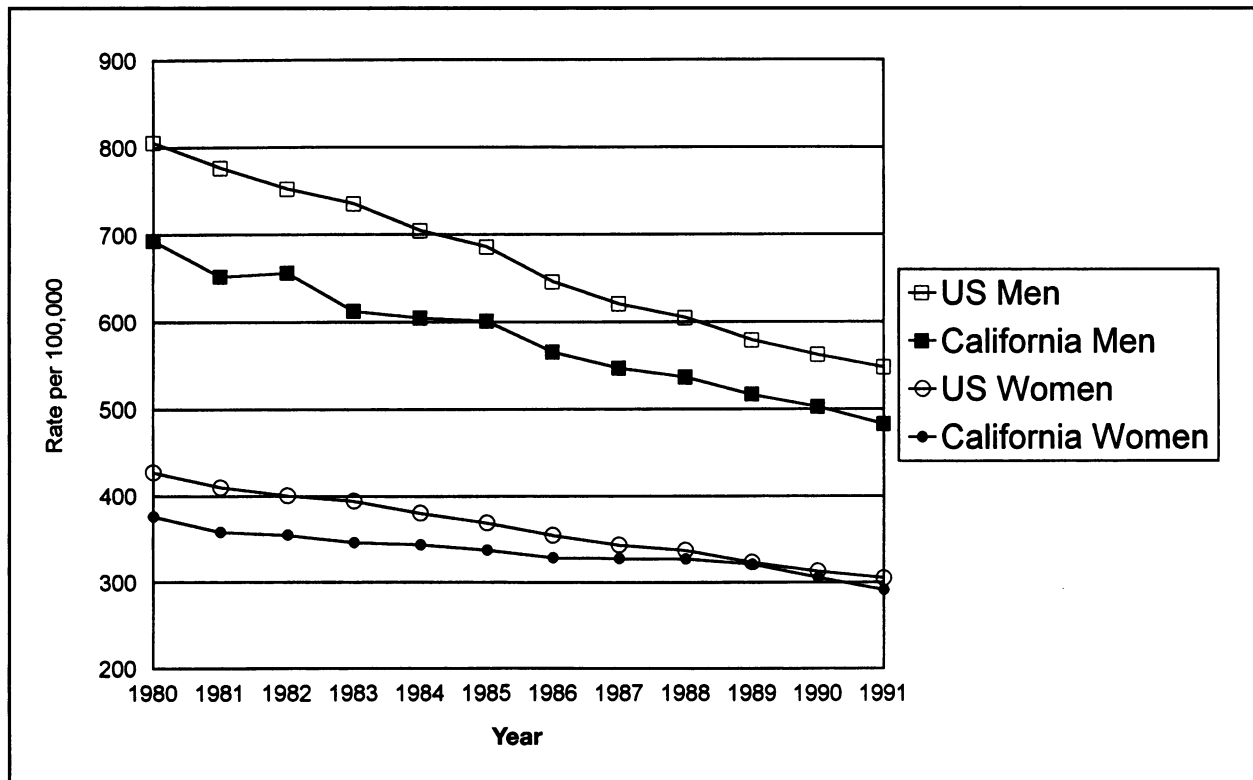


Figure 1.—Age-adjusted rates (to 1980 US population) of ischemic heart disease mortality for California and the United States are shown for 1980 through 1991 in persons aged  $\geq 35$  by sex.

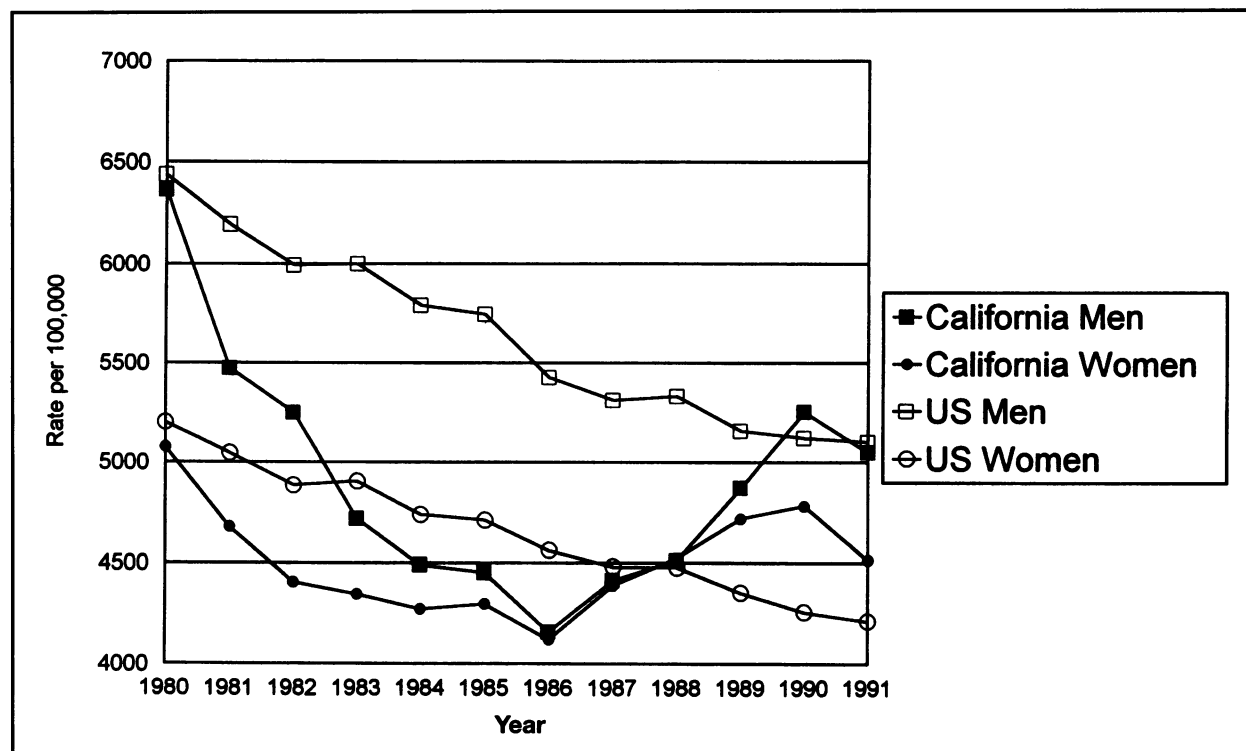


Figure 2.—Age-specific rates of ischemic heart disease mortality for California and the United States are shown for 1980 through 1991 for persons aged ≥85 years by sex.

than the rest of the country, the current rate of decline in California is slower than the rate of decline for the United States. Sex patterns have been similar for California and the United States, with men showing faster rates of decline than women.

Various explanations have been offered for the consistent declines in IHD mortality in the United States since the 1960s.<sup>11</sup> Investigators agree that the declines have been real rather than a statistical or reporting artifact.<sup>2,12</sup> Ecologic analyses have indicated that countries with active approaches to primary prevention have had declining rates of IHD, whereas countries without such measures have had increasing rates of IHD.<sup>11,13,14</sup> The relative contributions of primary prevention campaigns such as the National Heart, Lung, and Blood Institute's National High Blood Pressure (1972) and Cholesterol (1985) Education Programs and secondary prevention (medical care for those with clinically manifest disease) have been a source of ongoing debate, partly because the decline in IHD mortality in the United States began before these large-scale prevention efforts were initiated.<sup>6,11,12,15</sup> Declines in the incidence of IHD and some, but not all, associated risk factors have been observed along with improvements in case-fatality rates.<sup>16</sup> For the period 1985 to 1990, the Minnesota Heart Survey study showed greater declines in in-hospital mortality than out-of-hospital mortality due to IHD, suggesting greater benefits from advances in acute medical care—thrombolytic therapy, heparin, aspirin, and coronary angioplasty—relative to primary prevention in recent years.<sup>17</sup>

Possible explanations for the slower rates of decline in IHD mortality in California compared with the United States fall into the following categories: slower declines in the incidence of IHD, differences in the patterns of reporting cause of death on death certificates, differences in the secular trends of risk factors for IHD, slower declines in case-fatality rates, and a floor effect—that is, declines in the rates slow down when the rates approach their lower limit. The rising IHD mortality after 1985 in California for persons 85 years and older, coupled with the rapid declines in IHD mortality during the two previous decades, suggest that secondary and tertiary prevention may have extended the life of older persons with IHD who, although ultimately dying of the disease, did so at an older age. Given the absence of state- or community-level registries for myocardial infarction, it is not possible to compare the incidence of IHD in California with that in the United States. The few regions for which incidence data are available indicate slight increases in the incidence of IHD in the United States, especially among women, during 1980 through 1989, whereas rates of hospital admissions increased and then decreased during the same period.<sup>18</sup> Data on trends in California hospital admission and case-fatality rates have not been analyzed. The diagnostic error on death certificates and differences in the death certificate reporting patterns are difficult to quantify. The slower rates of decline in those groups with the lowest rates (Californians and women) suggest the possibility of a floor effect. Rates from other parts of the world, howev-

er, indicate the potential to be substantially lower before such an effect should be considered.<sup>19</sup> For example, compared with women in the United States, Japanese women currently have 45% lower rates of mortality from circulatory system diseases (predominately IHD) and have had almost twice the rate of decline in those rates during the past decade.<sup>20</sup>

The decline in male-to-female ratios of IHD mortality among the younger age groups during the study period in both California and the United States reflects the faster rates of decline of IHD mortality among younger men than younger women. This finding is in keeping with previous studies of declining IHD mortality during the 1970s and 1980s.<sup>16,21</sup> In contrast, men and women had similar rates of cardiovascular disease mortality in the 1920s, followed by a steadily increasing male-to-female ratio of IHD mortality until the 1960s, especially among the younger age groups.<sup>2,6,22</sup>

The complexities of the person, place, and time characteristics of a state or a country make cause-and-effect interpretations of spatial and secular trends difficult, if not impossible. Basic descriptive analyses of secular and spatial trends, however, such as those reported here, are still vital benchmarks for our public health efforts. It is reassuring that IHD mortality continues to drop in the United States and in California, where the decline preceded that in almost all other states.

Despite the favorable declines in IHD death rates in California and the United States, we must avoid complacency. These rates are still substantially higher than in other industrialized countries, with the United States ranking 10th for men and 9th for women for IHD deaths among 27 industrialized countries.<sup>23</sup> Even though the decline of IHD in the United States has been noted as “phenomenal” and “one of the great successes in preventive medicine,” IHD continues to pose a serious public health threat, resulting in about one in every four deaths.

A summary report of the Task Force on Research in Epidemiology and Prevention of Cardiovascular Diseases suggests the potential “to accelerate the rate of decline in coronary heart disease mortality to about 6% per year, yielding an overall reduction in coronary heart disease mortality of almost 50% in 10 years.”<sup>24(p2610)</sup> These startling estimates indicate that aggressive IHD prevention and control could have enormously beneficial effects on future public health.

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